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Original

Malnutrition prevalence in hospitalized elderly diabetic patients

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Abstract

Background & aims: **Malnutrition prevalence is unknown among elderly patients with diabetes mellitus. Our objectives were to determine malnutrition prevalence in elderly in patients with diabetes, and to describe their impact on prognosis.**

Methods: **An observational multicenter study was conducted in 35 Spanish hospitals. Malnutrition was assessed with the Mini Nutritional Assessment (MNA) tool. Patients were followed until discharge.**

Results: **1,090 subjects were included (78 ± 7.1 years; 50% males). 39.1% had risk of malnutrition, and 21.2% malnutrition. A 15.5% of the malnourished subjects and 31.9 % of those at risk had a BMI ≥ 30 kg/m². In multivariate analysis, female gender (OR = 1.38; 95% CI: 1.19-1.11), age (OR = 1.04; 95% CI: 1.02-1.06) and presence of diabetic complications (OR = 1.97; 95% CI: 1.52-2.56) were associated with malnutrition. Length of stay (LOS) was longer in at-risk and malnourished patients than in well-nourished (12.7 ± 9.9 and 15.7 ± 12.8 days *vs* 10.7 ± 9.9 days; p < 0.0001). After adjustment by age and gender, MNA score (OR = 0.895; 95% CI 0.814-0.985) and albumin (OR = 0.441; 95% CI 0.212-0.915) were associated with mortality. MNA score was associated with the probability of home discharge (OR = 1.150; 95% CI 1.084-1.219).**

Conclusion: A high prevalence of malnutrition among elderly in patients with diabetes was observed, regardless of BMI. Malnutrition, albumin, and MNA score were related to LOS, mortality and home discharge.

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Key words: *Malnutrition. Diabetes mellitus. Aged. Prevalence. Mortality.*

PREVALENCIA DE DESNUTRICIÓN EN ANCIANOS HOSPITALIZADOS CON DIABETES MELLITUS

Resumen

Introducción: **La prevalencia de desnutrición es desconocida entre los ancianos con diabetes mellitus.**

Objetivos: **Determinar la prevalencia de desnutrición en ancianos hospitalizados con diabetes mellitus, y describir su impacto en el pronóstico clínico.**

Material y métodos: **Se llevó a cabo un estudio multicéntrico en 35 hospitales españoles. La desnutrición fue valorada mediante la herramienta Mini Nutritional Assessment (MNA). Los pacientes fueron seguidos hasta el alta.**

Resultados: **Fueron incluidos 1.090 sujetos (78 ± 7,1 años; 50% hombres). 39,1% mostraron riesgo de desnutrición y 21,2% desnutrición establecida. El 15,5% de los sujetos desnutridos y 31,9 % de aquellos en riesgo tenían un IMC ≥ 30 kg/m². En el análisis multivariante, el sexo femenino (OR = 1,38; IC 95%: 1,19-1,11), la edad (OR = 1,04; IC 95%: 1,02-1,06) y la presencia de complicaciones por diabetes (OR = 1,97; IC 95%: 1,52-2,56) se asociaron al diagnóstico de desnutrición. La estancia media fue mayor en sujetos en riesgo y con desnutrición que en los pacientes bien nutridos (12,7 ± 9,9 y 15,7 ± 12.8 días *vs* 10,7 ± 9,9 días; p < 0,0001). Tras ajustar por edad y sexo, la puntuación del MNA (OR = 0,895; IC 95% 0,814-0,985) y el valor de albúmina (OR = 0,441; IC 95% 0,212-0,915) se asociaron de forma independiente con la mortalidad. La puntuación del MNA se asoció con la probabilidad de alta a domicilio (OR = 1,150; IC 95% 1,084-1,219).**

Conclusiones: **Se observó una elevada prevalencia de desnutrición entre los ancianos hospitalizados con diabetes, independientemente del IMC. El diagnóstico de desnutrición, el valor de albúmina y la puntuación del MNA se asociaron con la estancia media, mortalidad y destino al alta.**

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Palabras clave: *Desnutrición. Diabetes mellitus. Ancianos. Prevalencia. Mortalidad.*

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Abbreviations

ESPEN: European Society for Clinical Nutrition and Metabolism.
MNA: Mini Nutritional Assessment.
LOS: Length of stay.
BMI: Body Mass Index.
NRS-2002: Nutritional Risk Screening.

Introduction

Malnutrition is a very common problem that affects approximately 30-50% of hospitalized patients. Hospital malnutrition is associated with an increase in morbidity, mortality, a higher readmission rate, need of rehabilitation support after discharge and, therefore, higher healthcare and social costs. In the elderly population, the prevalence of in-hospital malnutrition has been estimated to be between 12.5 and 78.9% in different Spanish studies.[1-9]

Diabetes mellitus is one of the most prevalent endocrine pathologies in the general population being especially prevalent in the elderly (those with an age over 65 years). Several studies have shown that prevalence increases with age, with data suggesting that around 20% of the western society population over 65 years of age have diabetes. The Spanish prevalence of diabetes mellitus in this range of age is somewhere between 30 and 43%.[10]

Diabetes is associated with an increased risk of suffering malnutrition and other geriatric syndromes. Data has been published on malnutrition prevalence in institutionalized elderly diabetic patients but not in hospital patients[11] and little is known on the impact that malnutrition has on the progression of the disease for which the patient was admitted.

Several tools have been used for the evaluation of nutritional status in the elderly. The European Society for Clinical Nutrition and Metabolism (ESPEN) recommends the use of the Mini Nutritional Assessment (MNA) tool because the predictive validity has been evaluated by demonstrating its association with adverse health outcome in fragile elderly patients. This tool also takes in account relevant physical and social aspects, and the dietary habits.[12,13] It has been evaluated in acute care facilities showing an inverse relationship between its final score and mortality.[14]

The purpose of this study was to determine the prevalence of malnutrition (assessed by the MNA tool) in diabetic patients older than 65 years, admitted to the internal medicine units of Spanish hospitals. We also aimed to study the impact that malnutrition has on their hospital length of stay (LOS), mortality, and destination following hospital discharge.

Research design and methods

Design

This observational, multisite study was carried out in 35 Spanish hospitals at all levels of care (fig. 1). The inclusion criteria were: patients 65 years of age or older, hospitalized in internal medicine units within the last 24-72 hours, with a diagnosis of any type diabetes mellitus prior to admission. All cases were consecutively included between May 2007 and May 2008. Those patients who refused to participate in the data

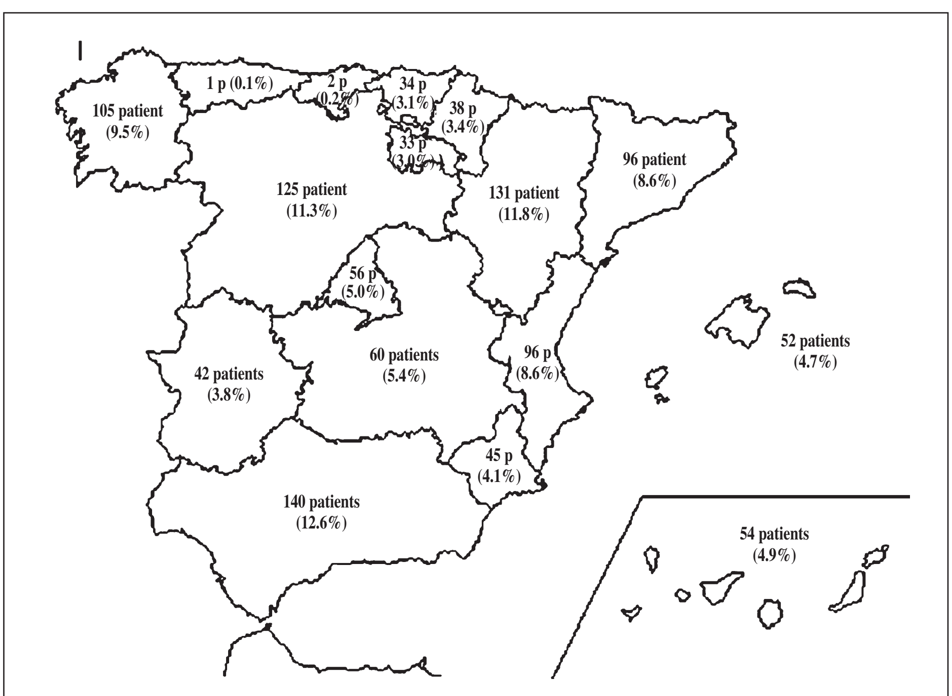

Fig. 1.—Regional distribution of patients in the study.

collection, newly diagnosed cases at admission —in order to exclude hyperglycemia due to stress—, those unable to complete the questionnaires due to their mental incapacity, and those who suffered from a serious disease in which death was considered imminent during the hospitalization were excluded from the study.

Demographic, and clinical variables related to diabetes mellitus were recorded as well as the cause for admission.

The nutritional evaluation was carried out with the MNA within the first 24-72 hours of hospital admission. This tool classifies patients as: normal nutritional status (24 points), at risk for malnutrition (from 17 to 23.5 points) and malnourished (less than 17 points). Weight and height were estimated in those patients in whom an objective measurement could not be obtained. Weight was estimated based on statements from the patient and/or family, and the height was estimated based on the elbow to styloid measurement. Calf and brachial circumferences were obtained with a non-elastic measuring tape in the non-dominant extremities. The questionnaire was completed using the responses from the patient or their caregivers.

Glucose levels, lipid profile and albumin levels were determined at admission and discharge. The tests were done in each hospital's laboratory using the same ISO norms methodology and using the same reference values.

Hospital length of stay and the patient's destination upon discharge were recorded.

The Clinical Research Ethics Committee (CREC) at Hospital Universitario La Paz De Madrid approved the project.

Statistical analysis

To calculate the sample size, the malnutrition prevalence was estimated between 20-50% in diabetic patients. With a 95% confidence interval, and a 2.5% level of precision, we calculated a study sample of 1,110 patients considering the usual 10% drop out.

Categorical variables are described using their absolute and relative frequency distribution. Continuous variables are expressed as the mean and standard deviation. Statistical tests were performed to evaluate normality of the variables. Comparisons between the different nutritional states have been made using the chi-squared test for categorical variables and the Mann-Whitney or Kruskal-Wallis test for continuous variables. In order to adjust for gender and age, the Cochran Mantel-Haenszel test was used. Logistic regression was used for the multivariate analysis, with nutritional status according to the MNA used as the dependent variable (with at risk for malnutrition and malnutrition combined on one side, and good nutritional status on the other reference category). The level of significance used was 0.05. All statistical analyses were performed using SAS v. 8.2 software.

Results

One thousand one hundred and ten patients were recruited during the study period. Of these, 12 patients were finally excluded for the analysis (5 for being under 65 years of age and 7 because they were unable to complete the MNA). Table I shows the patients'

Table I
Baseline characteristics of the study population

	Total *n = 1,098*	*Men* *n = 548*	*Women* *n = 549*
Age (mean ± SD) in years (range)	78 ± 7.1 (65-107)	77 ± 6.8 (65-97)	79 ± 7.3 (65-107)
BMI (mean ± SD) kg/m²	27.9 ± 5.7	27 ± 4.7	28.8 ± 6.4
BMI ≥ 30 kg/m² n (%)	349 (31.8)	145 (26.5)	204 (37.2)
Time since onset of diabetes			
< 10 years n (%)	530 (48.8)	275 (50.6)	255 (47.1)
> 10 years n (%)	556 (51.2)	268 (49.4)	287 (52.9)
Diabetic complications	662 (60.5)	331 (60.4)	330 (60.4)
Microvascular n (%)	362 (54.8)	175 (52.9)	187 (56.7)
Macrovascular n (%)	510 (77.2)	266 (80.4)	244 (73.9)
Reason for admission n (%)			
Pneumonia/Respiratory Insufficiency	353 (32.4)	193 (35.5)	160 (29.3)
Heart failure	286 (26.2)	126 (23.2)	160 (29.3)
Metabolic decompensation	122 (11.2)	58 (10.7)	64 (11.7)
Cerebrovascular disease	94 (8.6)	46 (8.5)	47 (8.6)
Coronary artery disease	79 (7.2)	42 (7.7)	37 (6.8)
Urinary tract infection	78 (7.1)	33 (6.1)	46 (8.4)
Acute gastroenteritis	76 (7)	32 (5.9)	44 (8.1)
Neoplasm	59 (5.4)	39 (7.2)	20 (3.7)
Neurological/Cognitive deterioration	57 (5.2)	32 (5.9)	25 (4.6)
Constitutional syndrome	47 (4.3)	26 (4.8)	21 (3.8)
Other	336 (30.8)	166 (30.5)	170 (31.1)

Table II
Characteristics of each patient group according to nutritional status

	Normal nutrition	*At risk*	*Malnutrition*
Age (mean ± SD) in years*	76 ± 7.3	78 ± 6.9	80 ± 6.8
*Men** n (%)*	251 (57.7)	193 (45)	104 (44.6)
BMI (mean ± SD) kg/m²*	29.4 ± 5.1	28.1 ± 5.5	24.7 ± 6
*BMI** > 30 kg/m² n (%)*	176 (40.5)	137 (31.9)	36 (15.5)
*Time since onset of diabetes***			
< 10 years n (%)	237 (54.6)	194 (45.8)	99 (43.4)
> 10 years n (%)	197 (45.4)	230 (54.2)	129 (56.6)
*Diabetic complications***	218 (50.1)	275 (64.1)	169 (73.2)
Microvascular n (%)	122 (56)	146 (53.1)	95 (56.2)
Macrovascular n (%)	147 (67.4)	222 (80.7)	141 (83.4)
Reason for admission n (%)			
Pneumonia/Respiratory Insufficiency	127 (29.5)	149 (34.8)	77 (33)
Heart failure	98 (22.8)	122 (28.5)	66 (28.3)
Urinary tract infection	30 (7)	31 (7.2)	17 (7.3)
Metabolic decompensation	50 (11.6)	51 (11.9)	21 (9.0)
Cerebrovascular disease	39 (9.1)	29 (6.8)	26 (11.2)
Coronary artery disease	40 (9.3)	32 (7.5)	7 (3.0)
Peripheral artery disease	13 (3.0)	10 (2.3)	6 (2.6)
Neurological/Cognitive deterioration	23 (5.3)	18 (4.2)	16 (6.9)
Acute gastrointestinal disease	24 (5.6)	34 (7.9)	18 (7.7)
Neoplasm	19 (4.4)	23 (5.4)	17 (7.3)
Constitutional syndrome	6 (1.4)	22 (5.1)	19 (8.2)
Other	130 (30.2)	140 (32.7)	66 (28.3)

baseline characteristics. Women were older than men (79 ± 7.3 *vs* 77 ± 6.8 years) and had a higher BMI (28.8 ± 6.4 *vs* 27 ± 4.7 kg/m²) These differences was (or was not) statistically significant.

Fifty one percent of the sample had had diabetes for at least 10 years, and 60% suffered a diabetic chronic complication. Macro vascular complications were more prevalent than micro vascular (77.2% *vs* 54.8%).

Before admission 33.3 % and 69.1 % of the patients were on insulin and on oral hypoglycemic agents, respectively. During hospitalization insulin was prescribed to 81.9 % of patients, and 33.3 % were treated with oral hypoglycemic agents.

Nutritional evaluation and factors associated with malnutrition

Based on the MNA classification, 39.7% (MNA score 25.7 ± 1.39) of subjects had a good nutritional status, 39.1% (MNA score 20.4 ± 1.90) were at risk, and 21.2% (MNA score 12.9 ± 3.51) were considered malnourished. The mean overall MNA score was 19.7 points. Table II shows the patient's characteristic according to their nutritional status.

Malnourished patients were older (80 ± 6.8 *vs* 76 ± 7.3 years; p < 0.0001) and had a lower BMI (24.7 ± 6 *vs* 29.4 ± 5.1 kg/m²; p < 0.0001) than those patients with good nutritional status. A higher percentage of malnourished patients were women (55.4%; p = 0.0002), had had diabetes for at least 10 years (56.6 *vs* 45.4%; p = 0.0065) and had higher percentage of diabetic complications, mainly macroangiopathy (83.4 *vs* 67.4%; p < 0.0001). In the multivariate analysis, the variables that were independently associated with the diagnosis of malnutrition were gender (OR for women versus men: 1.372; 95% CI: 1.513-1.190), age (OR = 1.04; 95% CI: 1.023-1.061) and the presence of diabetic complications (OR = 1.973; 95% CI: 1.519-2.563). No association was found between time of diabetes onset and malnutrition diagnosis.

Albumin levels were statistically significant different between nutritional status groups according to the MNA scores (3.6 g/dl in patients with normal nutrition, 3.4 g/dl in patients at risk for malnutrition, and 3.1 g/dl in malnourished patients; p < 0.0001 for all comparisons). Figure 2 shows albumin levels distribution according to the nutritional status: a greater percentage of patients with malnutrition had albumin levels below 2.5 g/dl and a majority of patients with normal nutrition had normal albumin values (> 3.5 g/dl).

Glucose levels at admission were not related to the patients' nutritional status measured by the MNA.

Hospital stay and destination at discharge

Hospital stay was longer in at-risk and malnourished patients (12.7 ± 9.9 and 15.7 ± 12.8 days, respectively) compared with normal-nourished patients (10.7 ± 9.9 days; p < 0.0001), independently of age and gender.

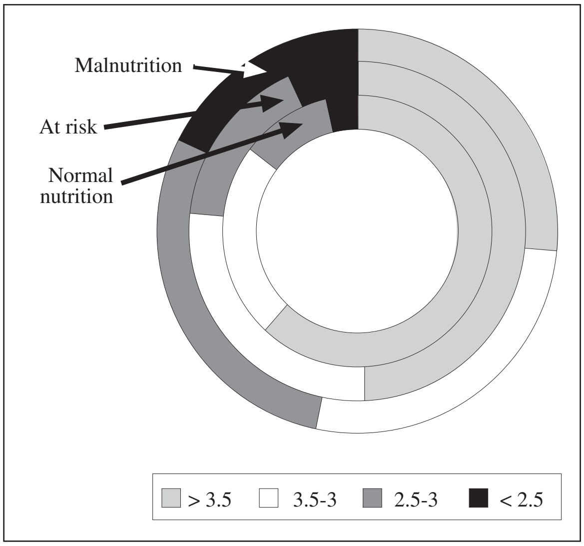

Fig. 2.—Distribution of albumin levels according to nutritional status by MNA.

Four percent of the patients died during their admission, 50% of them in patients with malnutrition and 14.3% in normal nutritional patients.

MNA score was associated with a higher probability of death. In the multivariate analysis, after adjusting for age and gender, MNA score (OR = 0.895; 95% CI 0.814-0.985) and the albumin level at admission (OR = 0.441; 95% CI 0.212-0.915) were factors that were independently associated with mortality.

Eighty nine percent of subjects with a normal nutritional status, and 86.3% of those at risk for malnutrition, were discharged home. Only 64.9% of patients returned home in the malnutrition patient group. A higher percentage of patients with malnutrition (6.2%) required a continued care facility compared with those at-risk (4.7%) and those with normal nutritional status (3.1%). In the multivariate analysis, only MNA score was independently associated with the probability of discharge home (OR = 1.150; 95% CI 1.084-1.219).

Basal glucose levels were not related to length of stay nor mortality.

Discussion

Performing a nutritional evaluation on admission in hospitalized patients has a great impact on patient's evolution and healthcare costs; this is supported by several studies and societies recommendations.[15-18] A higher risk of malnutrition has been seen in ambulatory diabetic patients compared with non-diabetics[19] using the MNA questionnaire as the evaluation tool. However, the prevalence of malnutrition in diabetic patients 65 years of age or older admitted to acute care facilities is still unknown.

This is the first multicenter study that analyzes the nutritional status with the MNA tool in a relatively large sample of elderly diabetic patients who were hospitalized in different internal medicine units from several Spanish hospitals. The large number of patients from several hospitals located throughout Spain, and the cross sectional design of the nutritional evaluation, provides a snapshot of the nutritional status of this specific population and justifies the validity of this study. The prospective information (LOS, destination, mortality) was obtained from the patient's medical records on discharge, so there was no intervention other than the usual clinical practice in each of the participating centers.

Prevalence of risk of malnutrition and malnutrition was 39.1% and 21.2%, respectively. Other studies, using the MNA, have shown higher percentages of malnutrition and risk of malnutrition than in ours. In one Spanish study of 200 elderly patients with acute disease,[2] malnutrition was detected in 50% of them and the risk for suffering malnutrition in 37.5%. Another study performed in Sweden on 83 elderly patients, the prevalence of at-risk and malnourished patients, was 56% and 26% respectively20. None of these two studies has described the prevalence of diabetes mellitus in their study sample. A review of 35 studies in hospitalized elderly patients evaluated with the MNA, the prevalence of malnutrition and risk of malnutrition was 23% and 46% respectively,[21] close to the values found in the present study. In Belgium, among 2,329 multicenter elderly inpatients —455 (11.9%) with diabetes mellitus diagnosis—, the malnutrition and malnutrition risk assessed with MNA was 33% and 43%, respectively, near our malnutrition prevalence. However, in that sample, the malnutrition prevalence was statistically similar in aged patients with and without diabetes (31.6% and 33.3%).22 A single hospital Swiss study assessing malnutrition with complete MNA in 164 inpatients over 75 years (37.2% with diabetes mellitus) found malnutrition and risk of malnutrition prevalence of 17.2% and 53.4%, lower and higher respectively than that observed by us.[23]

Recently, a Spanish nationwide, multicenter study in hospitals (PREDyCES) has been published. The prevalence of malnutrition at admission was 23%, close to our data. However, only 22.6% diabetics patients, and 55% elders over 64 years were included. Unlike ours, the Nutritional Risk Screening 2002 (NRS 2002) tool -proposed by ESPEN as a screening tool in hospitals-was used to assess nutritional status. Diabetes mellitus diagnose at admission was associated with a higher probability of being malnourished —adjusted OR 1.4 (1.03-1.92); malnutrition prevalence 30.1%—[8]

In our study, more than 65% of the sample was overweight or obese. Although a higher percentage with a BMI > 30 kg/m^2 was seen in the group with normal nutritional status, a 15.5% of the malnourished patients could be classified as obese. In the previously mentioned Spanish article[2] on hospitalized elderly patients, the mean BMI was 24.3 kg/m^2; however, the prevalence of diabetes in the studied subjects was not described. Type 2 diabetes is associated with being overweight and obese, and then it is expected to find our diabetic elderly patients, though suffering some level of malnutrition, with higher BMI than those without diabetes. Although we didn t record the diabetes type diagnosed, it is reasonable to assume that the majority of the patients, if not all, suffered type 2 diabetes because of their age. On the MNA, the item on BMI scores 3 points when it is > 23 kg/m^2. Given that an increased number of subjects in our sample had a BMI within the overweight or obese ranges, it is possible that the overall MNA score could have been slightly influenced by this fact. Some authors have suggested that changing the cutoff points for the anthropometric parameters on the MNA according to a reference population may improve the ability of the test to correctly classify subjects.[24] It appears prudent to adopt a higher normal reference value for the BMI than what is currently used for the general population. A BMI between 24 and 29 kg/m^2 has been suggested as an ideal cut off value to be used in elderly patients admitted to acute care facilities in order to avoid underestimating malnutrition;[25] however, adjustments have not been made for the presence of diabetes. A source of bias in our study could be that in several patients the actual weight was estimated and not measured. Nevertheless, weight recording by general physicians is a common practice among patients that could not stand up to measure weight so reported weights measured before admission are quite accurate.

In our study the variables that were independently associated with malnutrition were age, gender and the presence of diabetic complications. It is well-known that nutritional status worsens with age. The association between gender and malnutrition was also previously described in another Spanish study carried out on elderly ambulatory patients. Although the sample was not comparable, a higher percentage of women were classified malnourished by the MNA than men.[26] This result may be interpreted as a direct effect of age if we consider that women have a higher life expectancy than men and, therefore, those reach a higher age. In the Belgium study, gender was not associated to malnutrition, but elderly over 85 years had a higher probability of being malnourished. It must be noticed that all the included patients were over 75. It is possible that this circumstance minimized the gender effect seen in our study where the inclusion criteria of entry was 65 years old.[22] As such, a longer history of diabetes and the presence of complications of the disease were associated with a lower total score on the MNA test.

The duration of diabetes has been associated with the appearance of chronic complications and morbidity. An increased prevalence of malnutrition has been described in patients with nephropathy[27] and diabetic foot ulcers,[28] however, there are no data comparing the nutritional status of elderly diabetics with and without diabetic complications. Interestingly, the complication most frequently related to the presence of malnutrition in our study was macrovascular disease.

As expected, the mean plasma albumin level was greater in patients with normal nutrition status (3.6 g/dl) than in malnourished (3.1 g/dl) or at risk patients (3.4 g/dl). In addition, a higher percentage of malnourished patients had albumin levels below 2.5 g/dl. Therefore, patients with lower MNA scores also had a higher level of visceral protein depletion. This component of protein malnutrition may be related to the effect of the acute disease that led to hospitalization. A significant correlation between MNA and serum albumin has also been described in other studies.[2,23]

Mean LOS was greater in patients at risk for malnutrition and malnourished, with a mean difference of 2 and 5 days, respectively, compared with those with normal nutrition status. This difference was statistically significant regardless of the patients' age and gender, confirming the impact that the nutritional status has on health care costs. Other studies performed in geriatric hospitals have also found an increased mean hospital stay in malnourished subjects (42 days versus 30 days),29 while any did not.[23]

Half of in-hospital deaths occurred in malnourished patients. In addition, the two factors that were independently associated with death were overall MNA score and plasma albumin level. Our data are in line with other studies in which an in-hospital death rate between 18.4% and 38.7% was seen in patients classified as malnourished according to their MNA score. Lower MNA scores were also associated with an increased mortality.[14,30] A study using MNA Short Form did not find an association between malnutrition and in-hospital mortality.[23]

Functional recovery in malnourished patients was also shown to be lower since a lower percentage of malnourished patients were able to return to home after discharge. They also required continuous care at a higher percentage. The final MNA score was the unique factor that was independently associated with discharge home. This association has been described in other studies[31] but not in all of them.[23]

In our study, 36% of patients were overweight, 31.8% obese and 29.3% had normal values, based on the BMI classification, and taking 25 kg/m^2 as the cutoff point. Again we emphasized that 15.5% of the malnourished population according to the MNA were obese with BMI values ≥ 30 kg/m^2.

Our findings are similar to other studies that also used the MNA as a tool for evaluating the nutritional status of geriatric patients with acute disease. Nevertheless, as previously discussed, is the fact of being overweight or obese in our sample which could have influenced the final MNA score, and thereby underestimate the frequency of nutritional alterations. This important factor should be kept in mind when the MNA is used in subjects with diabetes who are also obese. However, in our study, the MNA classification was shown to be related with mortality, LOS and destination at discharge, indicating that MNA is a useful tool in the overall evaluation of geriatric patients.

Although ESPEN recommends the Nutritional Risk Screening (NRS-2002) tool to assess the nutritional status at admission12, we chose the MNA because it is a well validated tool for geriatric population that correlates with length of hospital stay and associated costs of hospitalization, and also with mortality. Nevertheless, a limitation of our study is that illness severity is not taken into account with this tool.

The results of our study once again reveals a high prevalence of malnutrition and, therefore, the importance of performing an evaluation of the nutritional status in elderly diabetic patients at the time of admission to any acute care unit, regardless of their BMI. This simple evaluation could trigger an early intervention to avoid important complications that are inherent to malnutrition.

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References

1. Asensio A, Ramos A, Núñez S. Prognostic factors for mortality related to nutritional status in the hospitalized elderly. *Med Clin (Barc)* 2004; 123: 370-3.
2. Gómez Ramos MJ, González Valverde FM, Sánchez Álvarez C. Nutritional status of a hospitalised aged population. *Nutr Hosp* 2005; 20: 286-92.
3. Ramos Martínez A, Asensio Vegas A, Nunez Palomo A, Millán Santos I. Prevalence and risk factors associated to malnutrition in elderly inpatients. *An Med Inter* 2004; 21: 263-8.
4. Martínez Olmos MA, Martínez Vázquez MJ, López Sierra A, Morales Gorria MJ, Cal Bouzon S, Castro Núñez I et al. Detection of malnutrition risk in hospitalized elderly patients. *Nutr Hosp* 2002; 17: 22-7.
5. Pérez de la Cruz A, Lobo Tamer G, Orduna Espinosa R, Mellado Pasto C, Aguayo de Hoyos E, Ruiz Lopez MD. Malnutrition in hospitalized patients: prevalence and economic impact. *Med Clin (Barc)* 2004; 123: 201-6.
6. De Luis D, López Guzmán A. Nutritional status of adult patients admitted to internal medicine departments in public hospitals in Castilla y Leon, Spain - A multi-centre study. *Eur J Intern Med* 2006; 17: 556-60.
7. Planas M, Audivert S, Pérez-Portabella C, Burgos R, Puiggrós C, Casanelles JM, Rosselló J. Nutritional status among adult patients admitted to an university-affiliated hospital in Spain at the time of genoma. *Clin Nutr* 2004; 23: 1016-24.
8. Álvarez Hernández J, Planas Vila M, León Sanz M, García de Lorenzo A, Celaya Perez S, García Lorda P, Araujo K, Sarto Guerri B; on behalf of the PREDyCES researchers. Prevalence and costs of malnutrition in hospitalized patients; the PREDyCES Study. *Nutr Hosp* 2012; 27: 1049-59.
9. Burgos R, Sarto B, Elío I, Planas M, Forga M et al. Prevalence of malnutrition and its etiological factors in hospitals. *Nutr Hosp* 2012; 27: 469-76.
10. Soriger F, Goday A, Bosch-Comas A, Bordiú E, Calle-Pascual A, Carmena R et al. Prevalence of diabetes mellitus and impaired glucose regulation in Spain: the Di@bet. es Study. *Diabetologia* 2012: 55: 88-93.
11. Casimiro C, García Lorenzo A, Usan L y el Grupo de Estudio Cooperativo Geriátrico. Nutritional and metabolic status and dietary evaluation in institutionalized elderly patients with non-insulin dependent diabetes mellitus (NIDDM). *Nutr Hosp* 2001; 16 (3): 104-11.
12. Kondrup J, Allison SP, Elia M, Vellas B, Plauth M; Educational and Clinical Practice Committee, European Society of Parenteral and Enteral Nutrition (ESPEN). ESPEN guidelines for nutrition screening 2002. *Clin Nutr* 2003; 22: 415-21.
13. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: The Mini Nutritional Assessment as part of the geriatric evaluation. *Nutr Rev* 1996; 54: S59-65.
14. Kagansky N, Berner Y, Koren-Morag N, Perelman L, Knobler H, Levy S. Poor nutritional habits are predictors of poor outcome in very old hospitalized patients. *Am J Clin Nutr* 2005; 82: 784-91.
15. García de Lorenzo A, Álvarez J, Calvo MV, de Ulíbarri JI, del Río J, Galbán C, García Luna PP, García Peris P, La Roche F, León M, Planas M, Pérez de la Cruz A, Sánchez C, Villalobos JL. Conclusions of the II SENPE discussion forum on: hospital malnutrition. *Nutr Hosp* 2005; 20: 82-7.
16. Ulibarri JI, Burgos R, Lobo G, Martínez MA, Planas M, Pérez de la Cruz A, Villalobos JL; Grupo de Trabajo de Desnutrición de SENPE. Recommendations for assessing the hyponutrition risk in hospitalised patients. *Nutr Hosp* 2009; 24: 467-72.
17. Mueller C, Compher C, Ellen DM; American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) Board of Directors. A.S.P.E.N. clinical guidelines: Nutrition screening, assessment, and intervention in adults. *JPEN J Parenter Enteral Nutr* 2011; 35: 16-24.
18. García de Lorenzo A, Álvarez Hernández J, Planas M, Burgos R and Araujo K; the multidisciplinary consensus work-team on the approach to hospital malnutrition in Spain. Multidisciplinary consensus on the approach to hospital malnutrition in Spain. *Nutr Hosp* 2011; 26: 701-10.

19. Turnbull PJ, Sinclair AJ. Evaluation of nutritional status and its relationship with functional status in older citizens with diabetes mellitus using the mini nutritional assessment (MNA) tool- a preliminary investigation. *Nutr Health Aging* 2002; 6: 185-9.
20. Persson MD, Brismar KE, Katzarski KS, Nordenström J, Cederholm TE. Nutritional status using mini nutritional assessment and subjective global assessment predict mortality in geriatric patients. *J Am Geriatr Soc* 2002; 50: 1996-2002.
21. Guigoz Y. The Mini Nutritional Assessment (MNA) review of the literature--What does it tell us? *J Nutr Health Aging* 2006; 10: 466-85.
22. Vanderwee K, Clays E, Bocquaert I, Gobert M, Folens B, Defloor T. Malnutrition and associated factors in elderly hospital patients: a Belgian cross-sectional, multi-centre study. *Clin Nutr* 2010; 29: 469-76.
23. Vischer UM, Frangos E, Graf C, Gold G, Weiss L, Herrmann FR, Zekry D. The prognostic significance of malnutrition as assessed by the Mini Nutritional Assessment (MNA) in older hospitalized patients with a heavy disease burden. Clin Nutr. 2012; 31:113-17.
24. Tsai AC, Chang TL, Chen JT, Yang TW.Population-specific modifications of the short-form Mini Nutritional Assessment and Malnutrition Universal Screening Tool for elderly Taiwanese. *Int J Nurs Stud* 2009; 46: 1431-8.
25. Stevens J.Impact of age on associations between weight and mortality. *Nutr Rev* 2000; 58: 129-37.
26. Cuervo M, Ansorena D, Martínez-González MA, García A, Astiasarán I, Martínez JA. Impact of global and subjective mini nutritional assessment (MNA) questions on the evaluation of the nutritional status: the role of gender and age. *Arch Gerontol Geriatr* 2009; 49: 69-73.
27. Khan MS, Chandanpreet S, Kewal K, Sanjay D, Ram KJ, Atul S. Malnutrition, anthropometric, and biochemical abnormalities in patients with diabetic nephropathy. *J Ren Nutr* 2009; 19: 275-82.
28. Eneroth M, Larsson J, Oscarsson C, Apelqvist J. Nutritional supplementation for diabetic foot ulcers: the first RCT. *Wound Care* 2004; 13: 230-4.
29. Van Nes MC,Herrmann FR, Gold G, Michel JP, Rizzoli R. Does the mini nutritional assessment predict hospitalization outcomes in older people? *Age Aging* 2001; 30: 221-6.
30. Donini LM, Savina C, Rosano A, et al. MNA predictive value in the follow up of geriatric patients. *J Nutr Health Aging* 2003; 5: 282-93.
31. Van Nes MC, Herrmann FR, Gold G, Michel JP, Rizzoli R. Does the mini nutritional assessment predict hospitalization outcomes in older people? *Age Aging* 2001; 30: 221-6.